products in furnishing certain of the raw materials needed in the manufacture of high explosives, the astonishing development of the coal-tar industry in Germany affords one more illustration of the means by which that country has so sedulously prepared herself for the titanic struggle upon which she has embarked.

It remains to be seen what the influence of the war will be on the future of tar production and distilling in this country. It is practically certain that Germany will no longer be the market for our intermediate tar-products that she has hitherto been. Dr. Lunge tells us, what we begin to realise, that Germany "is now in a position to furnish almost the whole of the requirements of coal-tar products for its colour industry, the largest in the world." What is in store for the colour industry with us is very difficult to forecast. Time and a more intelligent fiscal policy may tell. As we all know, attempts are being made to recover the great leeway we have lost by our lack of foresight and our want of an intelligent appreciation of the relation of science and research to industry. It is to be hoped, in the interest of our textile manufactures, that at least a certain measure of success may be reached. But it is questionable whether, on the lines of the present effort, the success will be very far-reaching. It is certain that the methods which are being employed are very different in character from those which have placed the industry in its present high position in Germany. It is no less certain that no other mode of direction than this last will be successful in the long run.

As compared with the preceding edition, which appeared in 1909, the most important factor of increase in the present work is in the section relating to ammonia, concerning which there has been a great development within recent years. Ammonia and ammoniacal compounds are, of course, used to a large and increasing extent in a great variety of industries, *e.g.* manufacture of alkali; coal-tar colours; in bleaching, dyeing, and calico-printing; in zinc-coating; explosives; artificial silk; medicine, pharmacy, and photography; and in the production of cold. But by far the largest amount of combined ammonia is used in agriculture. During the first decade of this century the consumption of ammonium sulphate rose from 125,000 to 322,000 tons, whereas during the same period the consumption of sodium nitrate rose from 470,000 to 637,000 tons—a far less rapid rate of increase than in the case of the ammoniacal salts, which is bound to get still less as the Chile beds approach exhaustion. Although synthetic methods of production of ammonia will play an increasingly important part, it is practically certain that the principal source of ammonia and its compounds will continue to be the nitrogen of coal, and it is on the development of the coking industry and on the recovery of the by-products formerly lost that the future of the ammonia industry will depend.

We heartily congratulate the veteran Professor Emeritus of the Zurich Federal Technical University on the appearance of this admirable work. Dr. Lunge deserves well of the industry which he has laboured so faithfully to serve. Every page of his treatise bears witness to the zeal and painstaking care with which it has been compiled and revised. The book, as hitherto, is admirably printed and excellently illustrated. Indeed, no efforts have been spared by all concerned to make it, what it unquestionably is, by far the most complete and authoritative work we have upon the important subjects of which it treats.

T. E. THORPE.

MATERIALS OF CONSTRUCTION.

The Structure and Properties of the More Common Materials of Construction. By G. B. Upton. Pp. v+327. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 10*s.* 6*d.* net.

THIS volume had its origin in a course of theoretical instruction preparatory to a laboratory course at Sibley College, Cornell University. The first part deals with the elastic theory and the determination of the properties of materials of construction, chiefly metals, by testing. The ordinary rules connecting stress and strain are discussed, but not in general the instruments used in testing. Rather more attention is given to the behaviour of materials strained beyond the elastic limit than in treatises on applied mechanics. Some of the statements are rather too dogmatic. Is the author sure that in a tension test "the break must start at the outside and work inwards" (p. 36)? English engineers will scarcely agree with the statement that "there is not much excuse for the use of the Rankine or Ritter formulas" for columns. It will be new to them to learn that "live loads applied without shock (for example, a rolling load crossing a bridge at low speed) actually set up stresses twice as great as a dead load of the same amount." The injurious effect of a live load without shock as compared with a dead load is, not that it increases the stresses, but that it causes the "fatigue" effect. Of course, also, it produces shocks, which the author deals with separately. A live load is not a suddenly applied load. Nevertheless, this section is generally clear and useful. The discussion of the cause of fatigue failure is fuller than usual. No attempt is made to give collections of results of tests.

The second and rather larger part of the book deals with the internal structure of materials and its modification by mechanical action, heat treatment, etc. Is it true that the corrosion of iron "takes place whenever the moisture in contact with the metal becomes electrolytic either by acids or *alkalies*"? Freezing-point and equilibrium diagrams for lead-tin and iron-carbon alloys are described, and the constituents of cast-iron and steel, austenite, pearlite, ferrite, cementite, etc., are discussed very fully. So also are the variation

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of the properties of steel with the carbon content and the influence of nickel, manganese, vanadium, chromium, etc. The author gives a general theory of the heat treatment of steels which is original, and which, the author believes, throws much light on practical problems and is certainly interesting. Cements are shortly treated in a final chapter.

Although some defects, probably due to haste, have been indicated, this treatise is really a good one and can be recommended to practical engineers as containing information not easily accessible elsewhere. Perhaps the fault of being rather too positive in accepting conclusions not fully established is one to which a teacher of students is specially liable.

SOUND ANALYSIS.

The Science of Musical Sounds. By Prof. D. C. Miller. Pp. viii + 286. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1916.) Price 10*s.* 6*d.* net.

UNDER the above title the author has presented in book form a series of eight lectures on sound analysis delivered at the Lowell Institute in January and February, 1914. A course of scientific lectures designed for the general public must consist in large part of elementary and well-known material, selected and arranged to develop the principal line of thought. But it is expected that lectures under the auspices of the Lowell Institute, however elementary their foundation, will present the most recent progress of the science in question. It is further expected that such lectures will be accompanied by experiments and illustrations to the greatest possible degree.

Thus, in the present work, we find that mathematical treatment is almost absent; the few equations that occur throughout its pages might be collected so as to appear at a single opening of the book. On the other hand, the figures number nearly two hundred, many of them being photographic reproductions of vibration curves or apparatus. These serve to indicate the wealth of the demonstrative material by which the lectures were illustrated.

The first lecture deals with sound-waves, simple harmonic motion, noise, and tone; the second with the characteristics of tones. The third lecture is concerned with methods of recording and photographing sound-waves, and includes a description of the author's special recorder called the *phonodeik.* Lectures four and five develop the analysis and synthesis of compound harmonic curves, and treat the influence of horn and diaphragm. The sixth and seventh lectures are concerned with the tone qualities of musical instruments and the physical characteristics of the vowels. The eighth lecture treats the problems of the synthesis of vowels and words, and concludes with remarks on the relations of the art and science of music.

The work includes a valuable bibliographic appendix of more than a hundred references. The type and illustrations are large and clear, and the book should prove welcome to a wide circle of readers and find an honoured place in every acoustical library.

E. H. B.

OUR BOOKSHELF.

Studies in Blood-Pressure, Physiological and Clinical. By Dr. George Oliver. Edited by Dr. W. D. Halliburton. Pp. xxiii + 240. Third edition. (London: H. K. Lewis and Co., Ltd., 1916.) Price 7*s.* 6*d.* net.

THIS posthumous edition opens with an obituary notice of the author by Prof. Halliburton, who has undertaken the duties of editor as a "true labour of affection and respect." This latest edition embodies the chief advances in the clinical investigation of blood-pressure, and contains a description of the author's own instruments for testing the pressure. It is argued that the condition of the vessel wall does not seriously interfere with correct readings; hypertonicity, which produces the greatest resistance, can be counteracted by repeated compression or massage. It is noteworthy that occupations involving anxiety, worry, and nerve strain tend to augment blood-pressure. It is pointed out that "pulse-pressure" (the difference between the systolic and the diastolic pressure) tends to increase after the age of forty. The suggestion that arterio-sclerosis may be so advanced as to cause an entire abolition of vasomotor control is open to question; for it is difficult to see how life could be carried on under such conditions. The author holds that widespread thickening of the arterial wall suffices to maintain long-continued high pressure, and that there is no need to postulate persistent hypertonicity of the arteries, which he considers physiologically improbable.

The Chemistry of the Garden: A Primer for Amateurs and Young Gardeners. By Herbert H. Cousins. Revised edition. Pp. xviii + 143. (London: Macmillan and Co., Ltd., 1916.) Price 1*s.*

WHEN the demand for a book is such that it needs to be reprinted eight times since its first issue in 1898 and now calls for a revised edition, it obviously needs little commendation to the public for whom it is written. Mr. Cousins's volume contains in its 143 pages a vast amount of information on the management of soil for the successful production of garden crops. In the new edition we notice reference to recent Rothamsted work on partial sterilisation and to the shortage of potash caused by the war. On the latter account the gardener need not worry, as any moderately good garden soil has ample reserves of potash, which can be made available as plant food by suitable treatment. We do not agree with two of the author's remarks on dung. He says that "no analysis is of much value": on the contrary, experience at Rothamsted and elsewhere shows that

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